THE BIOLOGY OF *HOPLITIS ROBUSTA* (HYMENOPTERA: MEGACHILIDAE)[1]

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ABSTRACT: The nesting biology of *Hoplitis (Formicapis) robusta* (Nylander) is described and illustrated. Six trap nests of this holarctic species were obtained from northwestern Wyoming.

Hoplitis robusta nests in existing burrows and utilizes masticated plant material for cell partitions and nest plugs. The cells are arranged in a linear series. Analysis of pollen-nectar provisions shows a single source, possibly a legume *(Trifolium* or *Astragalus).* The bee overwinters inside a cocoon as a post-defecating larvae.

DESCRIPTORS: Hymenoptera; Megachilidae; *Hoplitis robusta;* Wyoming. Biology, nesting, supersedure.

The genus *Hoplitis* Klug, as now recognized by bee authorities, contains 45 species separated into 12 subgenera in the Nearctic north of Mexico (Eickwort, 1970; Michener, 1968; Hurd and Michener, 1955). Biological information is known for eight species in six of the subgenera. The most extensively studied species are *H. anthocopoides* (Schenck) (Eickwort, 1970, 1973), *H. albifrons* (Kirby) (Fye, 1965), *H. cylindrica* (Cresson) (Fye, 1965; Hicks, 1926), and *H. producta* (Cresson) (Medler, 1961; Rau, 1928; Hicks, 1926; Comstock, 1924; Graenicher, 1905). Fragmentary accounts are available on the biology of *H. biscutellae* (Cockerell) (Stephen, et al., 1969; Linsely and MacSwain, 1943), *H. fulgida* (Cresson) and *H. hypocrita* (Cockerell) (Hicks, 1926), and *H. pilosifrons* (Cresson) (Michener, 1955). The purpose of this paper is to present biological information on *H. (Formicapis) robusta* (Nylander).

Hoplitis robusta is a holarctic species found at high elevations (2000 meters) in the mountainous regions of western North America and throughout Europe and Asia (Peters, 1970; Hurd and Michener, 1955). The bee is distinctive in both sexes with the female having a large head and a median apical snout on the clypeus. The seventh tergum of the male has a four-lobed apical margin (Hurd and Michener, 1955).

The nests reported on in this paper were kindly given to us by Professor Howard E. Evans, who conducted his studies along Pilgrim Creek in the Teton National Forest, Wyoming, and near the Jackson Hole Biological Research

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Station in Grand Teton National Park, Wyoming. The elevation of both study areas is about 2,077 meters. In both areas, broad fields of grasses and numerous species of wild flowers are broken by conspicuous stands of Lodgepole Pine, *Pinus contorta latifolia* Critchfield, and Quaking Aspen, *Populus tremuloides* Michx. Professor Evans put out the trap nests during the first week in July 1971 and collected them in mid-August of the same year.

Six nests were obtained from several locations near the Jackson Hole Research Station. All nests were from burrows in drilled pine blocks which were located from 0.3 to 2.0 meters off the ground and attached to dead pines and aspens or log cabins. Four of the nests were in 4.0 mm diameter burrows and the rest in 5.0 mm burrows. The cells were arranged in a linear series starting in the bottom of the burrow. The mean number of cells per nest was 9 (range 3 - 14). All cells (45) averaged 7.3 mm long (range 5.5-11 mm) with 21 female cells and 5 male cells averaging 7.6 mm and 7.0 mm in length, respectively. This sex ratio of 4♀:1♂ is not considered natural but most likely resulted from high rearing losses. Two of the nests contained all female progeny (5 and 11 celled nests) and the remaining nests contained both sexes. There was no indication from any of the nests containing both sexes that the female cells are formed first and male cells last in the burrow. Three of the nests contained vestibules following the last cell. They averaged 11.6 mm long (range 3-18 mm) and were not divided by partitions or filled with pieces of plant material or pebbles.

The cell partition was constructed of masticated green plant material. The thickness of the partition varied from 0.3-1.0 mm, and the lateral margins were smeared forward along the edge of the burrow wall giving the outer surface a concave shape (Fig. 1). The inner surface was flat. Some partitions had small pieces of wood embedded in the leaf matrix. Pebbles, large pieces of wood or plant parts were not found in any of the partitions.

The nest plug was flush with the burrow entrance in the completed nests and lacking in nests containing 5 or fewer cells. The plug was formed of multiple layers of masticated green plant material and varied from 10-14 mm in thickness. From 8 to 13 cell type partitions formed the thickness of the nest plug.

Although the nests were not examined until the winter, we were able to obtain information on pollen-nectar stores and egg position from cells

containing dead eggs. The light yellow pollen-nectar store was relatively dry, cylindrical in shape and filled the bottom 3/4 of the cell. The egg was positioned on top of the rounded provision with its posterior end slightly embedded near the outer edge of the provision, and the anterior end nearly touched the center of the rounded surface of the provision. Pollen analysis showed that the pollen from a cell was from the same species of plant and possibly from a legume *(Trifolium* or *Astragalus)* but specific identification was not possible. Hurd and Michener (1955) list only one floral record, *Taraxacum,* and Peters (1970) records *Silene rupestris* from Europe.

The fecal pellets of *H. robusta* are formed singly and vary from 0.2-0.3 mm wide and 0.4-0.5 mm long and have no surface groove or depressions. The dorsal surface on many of the pellets is flattened, however this was not seen on all of the pellets. They are slightly curved with rounded ends and vary in color from dark brown to light orange. The pellets were found scattered everywhere in the cell outside of the cocoon, but is some of the cells they were concentrated in the posterior portion of the cell (Fig. 1). The pellets are not incorporated into the cocoon, but posteriorly they may stain the cocoon brown.

The cocoon of *H. robusta* is extremely thin, translucent and is formed of two layers (Fig. 1). There is no anterior nipple or any evidence of one on the interior surface of the cocoon. The outer layer is a loose network of fine, white silk threads. These threads vary in thickness from 0.008-0.01 mm and many of the fecal pellets are held in this layer. The inner layer is about 0.01 mm thick and consists of fine white threads smeared with a clear matrix. The cocoon fills the cell and conforms to the shape of the cell.

Hoplitis robusta from the Wyoming area overwinter as post-defecating larvae.

Three additional nests were collected that contained *H. robusta* in a state of supersedure. In two cases, Evans (1973) found that *Symmorphus cristatus* (Saussure) had superseded *H. robusta.* In one nest, we found that *H. robusta* had superseded *Megachile relativa* Cresson in the second cell (Fig. 2) but was superseded in the third and subsequent cells by the foundress bee *M. relativa.* The *H. robusta* cell was preceded and followed by masticated plant material partitions and lacked the solid leaf cell of *M. relativa.* The pollen in the second cell was light yellow and differed from the red-brown pollen in the *Megachile* cells. Twelve nests of *M. relativa* were obtained from the area

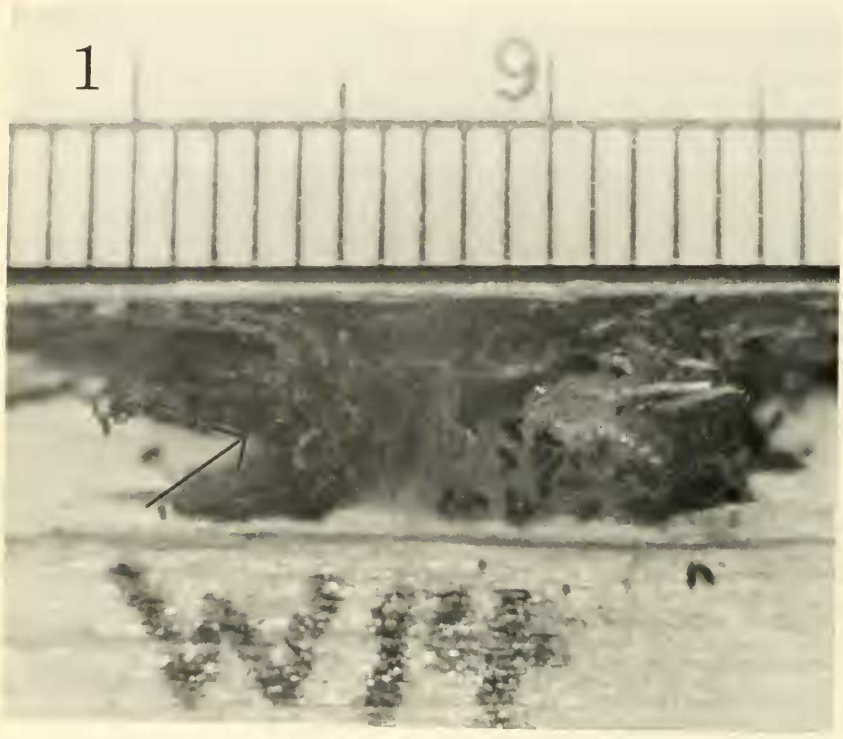

Fig. 1 – Single cell of *Hoplitis robusta* (Nylander), arrow indicates concave cell partition.

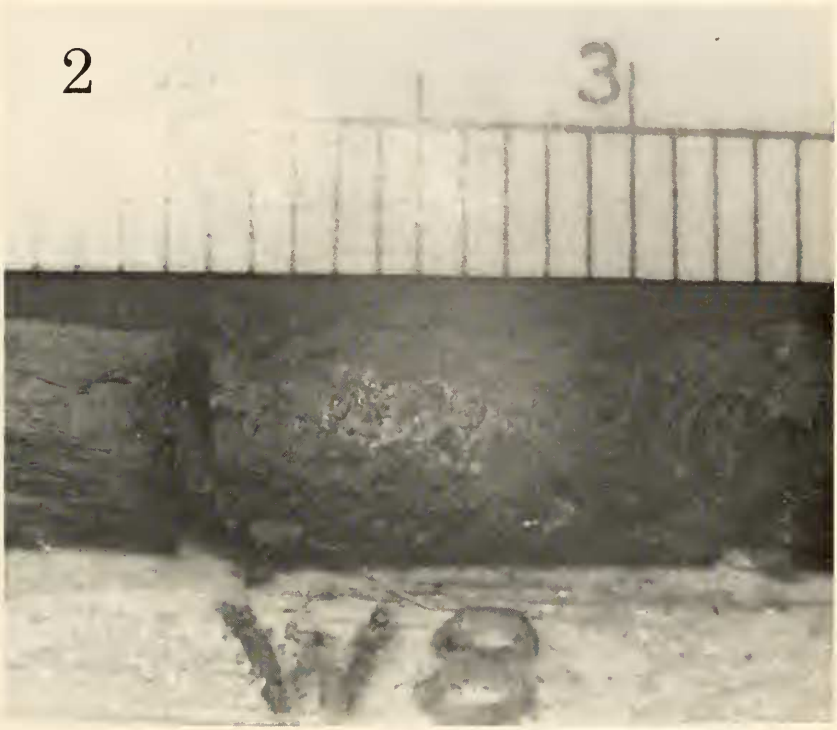

Fig. 2 – Nest of *Megachile relativa* Cresson superseded by *H. robusta* in the second cell.

around the Biological Station. All of the nests were from burrows of 5 mm or greater diameters. This suggests that there may be competition between *H. robusta, M. relativa* and *S. cristatus* for burrows with diameters around 5 mm.

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